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**Supplemental Agreement 2
Environmental Investigation
Final Report
Terminal 106 West
Seattle, Washington**

January 1992

**Ms. Elizabeth Stetz
Port of Seattle Engineering Department
P.O. Box 1209
Seattle, WA 98111**



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January 27, 1992

 Ms. Elizabeth Stetz
 Port of Seattle Engineering Department
 P.O. Box 1209
 Seattle, Washington 98111

**RE: SUPPLEMENTAL AGREEMENT 2, ENVIRONMENTAL INVESTIGATION
 FINAL REPORT; TERMINAL 106, SEATTLE, WASHINGTON**

Dear Ms. Stetz:

Enclosed please find Supplemental Agreement 2, Environmental Investigation Final Report for the CFS Transload Dock 1-10 area located at Terminal 106 West in Seattle, Washington. The purpose of this investigation was to better define the extent of potential heavy metal contamination near the surface near the CFS Transload Dock and to develop general costs associated with future remediation of the site. All work was performed under the annual consulting contract with the Port of Seattle and in accordance with the Supplemental Agreement 2 Scope of Services dated September 24, 1991 and approved by Walter D. Ritchie of the Port on September 24, 1991.

A draft report was provided to the Port for review and comment on October 28, 1991. Comments on the draft report were received during our meeting of November 4, 1991. This final report presents a detailed analysis of the results of the field investigation and includes the following information: a description of site activities, post hole/augering techniques, sampling procedures, results of data analysis, remedial options and general remedial costs. In addition, the document contains pertinent information such as sample transfer documentation, QA/QC information, decontamination procedures, and site plans.

Please call if you have any questions on this document.

Sincerely,

SHANNON & WILSON, INC.

 Michael C. Moore
 Senior Environmental Project Manager

Enclosure: Final Report

T1321-01.LT2/MCM-lkd/dgw

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TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION	1
2.0 PURPOSE	1
3.0 SITE DESCRIPTION AND BACKGROUND	1
4.0 SITE CONDITIONS	4
4.1 Regional Geology	4
4.2 Subsurface Soil Conditions	5
5.0 SAMPLE OPERATIONS	6
5.1 Sampling Rationale and Location	6
5.2 Coring and Augering Procedures	7
5.3 Borehole Abandonment Procedures	8
5.4 Decontamination Procedures	8
5.5 Sampling Activities	9
5.6 Field Logbooks	10
5.7 Chain-of-Custody	11
5.8 Field Screening (Flame Ionization Detector)	11
5.9 Sample Designation	12
5.10 Analytical Laboratory Testing and Reporting Program	12
6.0 TEST RESULTS	13
6.1 Extent of Contamination	15
7.0 REMEDIAL ALTERNATIVES	15
8.0 CONCLUSIONS AND RECOMMENDATIONS	18
9.0 CLOSURE	18
REFERENCES	20

TABLE OF CONTENTS (cont.)

LIST OF TABLES

Table
No.

- | | |
|---|--|
| 1 | Total Metal Laboratory Results |
| 2 | TCLP Metal Laboratory Results |
| 3 | Remedial Alternative 1 - Cost Estimate |
| 4 | Remedial Alternative 2 - Cost Estimate |

LIST OF FIGURES

Figure
No.

- | | |
|---|-------------------|
| 1 | Site Plan |
| 2 | Sampling Location |

LIST OF APPENDICES

- APPENDIX A - CHAIN-OF-CUSTODY RECORDS
APPENDIX B - SOUND ANALYTICAL SERVICES, INC. REPORTS

FINAL REPORT
ENVIRONMENTAL INVESTIGATION AT TERMINAL 106 WEST
SEATTLE, WASHINGTON

1.0 INTRODUCTION

This report presents the results of a preliminary environmental investigation at the CFS Transload Dock 1-10 located at Terminal 106 West in Seattle, Washington. This work was performed as part of the annual consulting contract between Shannon & Wilson, Inc. and the Port of Seattle (Port), and in accordance with the Supplemental Agreement 2 Scope of Services dated September 24, 1991 and approved by Walter Ritchie of the Port on September 24, 1991.

This report presents an analysis of the analytical laboratory results from a field investigation for potential lead, arsenic and chromium contamination. In addition, the document describes site activities, defines augering techniques, sampling procedures, Quality Assurance/Quality Control (QA/QC) information, remedial options and general remedial costs.

2.0 PURPOSE

The purpose of the environmental investigation was to better define the extent of potential heavy metal (lead, arsenic, and chromium) surface soil contamination to a depth of 3 to 4 feet. In addition, general costs associated with future remediation of the site were developed. The field investigation included installing and sampling 24 shallow boreholes, obtaining five perimeter surface soil samples, 10 sweep/wipe samples and five catch basin sediment samples. All field procedures were performed in accordance with Shannon & Wilson's Standard Operating Procedures (SOPs) and the Supplemental Agreement 2, Environmental Investigation at Terminal 106 West; Seattle, Washington, Scope of Services.

Analytical data obtained from this investigation provides information on lateral and vertical extent of heavy metals and stratigraphy of the soils in the area. This scope of work did not include an evaluation of groundwater quality or off-site areas.

3.0 SITE DESCRIPTION AND BACKGROUND

The Port requested that Shannon & Wilson, Inc. perform an environmental investigation at the Terminal 106 West Transload Dock located at 3629 Duwamish Avenue South, Seattle, Washing-

ton. An initial site inspection was conducted on September 16, 1991, the environmental investigation activities were initiated on October 1, 1991 and concluded on October 4, 1991.

The transload dock is a concrete platform with a timber and metal post roof structure. The platform measures approximately 20 feet by 275 feet. A 25-foot ramp is located on the east side of the dock. North of the transload dock is an asphalt-paved area. Warehouse W-3 (CFS Building 30) is located north of the paved area. Two active east-west trending railroad spur tracks are located 5 and 20 feet south of the transload dock. The area between the dock and the northernmost track is not paved. A concrete slab is located 20 feet south of the transload dock. The site is bordered to the south by Stoneway Concrete and to the west by the East Waterway of the Duwamish Waterway. East of the site are various warehouse buildings and Duwamish Avenue South. A chain link fence secures the site. A gate is located at the east end of the site and access is controlled by a Port security guard. The site plan and adjacent properties are shown in Figure 1.

The site is a working transload dock used to off-load lead, aluminum and copper ingots. Ingots are bundled together with steel strapping. Depending on the shipment, lead ingots vary in weight from 100 to 9,000 pounds. The ingots are transferred from railroad cars to shipping containers by forklifts. One forklift is utilized to move the bundled ingots from the railcar to the edge of a loading dock, a distance of 10 feet. A second forklift is used to move the "lead pallets" from the edge of the loading dock into large metal shipping containers which are stored on the asphalt area north of the transload dock. Sometimes lead bundles are directly unloaded into the shipping containers, or pallets are staged west of the transload dock.

Med-Tox Associates, Inc. performed an airborne lead survey and observed dock loading and unloading operations on August 20 to 21, 1990. At this time, lead debris was observed in the containers, on the loading dock, on the area between the loading dock and the containers, and in between the railroad cars. The Permissible Exposure Limit (PEL) for airborne lead as set by the Washington State General Occupational Health Standards, (WAC 296-62-07521) is 50 micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$). The action limit for airborne lead is 30 $\mu\text{g}/\text{m}^3$. All four of the samples which were collected from employees working in the dock area exceeded the Time Weighted Average (TWA) action limit for airborne lead content. In addition, three of the samples also exceeded the PEL for airborne lead content. The TWAs for airborne lead content ranged from 42 $\mu\text{g}/\text{m}^3$ to 410 $\mu\text{g}/\text{m}^3$. Recommendations and suggestions on work practices to conform to WAC 296-62-07521 were recorded at that time.

On November 13, 1991, Hazcon, Inc. evaluated workers' exposure to airborne lead during the process of unloading lead ingot bundles off railroad cars and loading them into shipping containers. Visible dust emissions were recorded during forklift loading operations. In addition, operational practices of sliding lead bundles on the container floor, boxcar floor, and over the surface of the transload dock were noted. Employees' exposure to lead exceeded the PEL in all cases, and ranged between 787 ug/m³ and 3168 ug/m³. Recommendations for the employer to comply with the provisions of Washington lead standard (WAC 296-62-07521) were outlined.

Hazcon, Inc. conducted a follow-up airborne lead survey during loading and unloading activities on January 7 and 11, 1991. During this sampling, it logged that lead bundles were handled more cautiously, and the lead cargo appeared to be much cleaner, therefore less visible dust was observed. Worker exposures on the January 7 were well below the PEL for lead. In addition, wipe and vacuum samples were collected on January 7 from the car floor, the dock, and on the ingot surface. Samples revealed concentrations up to 396 micrograms per kilogram (ug/kg). One bulk dust sample was collected from a dark gray dust pile on the floor of the car which contained 20.31 percent by weight of lead. The survey suggested that the dust on the car floors and on the ingots was a likely source of airborne lead exposures. Personal exposures were again monitored on January 11, and several samples were tested for both lead and antimony exposure. One of the samples exceeded the lead action level, antimony exposures were well below the PEL. Area samples and two bulk samples were also collected on this day. Area samples were obtained from three different cars and results were all below the lead action level. Two bulk dust samples were collected, one from a light colored dust laying on the floor of the boxcar and another from a black colored dust on top of the ingots. Results of these samples revealed 4.4 percent and 25 percent by weight of lead, respectively. In addition to similar recommendations as outlined in previous surveys, an environmental clean up was recommended.

An additional airborne lead survey was conducted by Hazcon, Inc. on January 22, 1991. The results of the survey showed that the two workers unloading the cars had exposures of 39 ug/m³ and 59 ug/m³. The exposure to a third worker loading the container was well below the PEL.

On January 22, Asarco also obtained industrial hygiene samples. One sample exceeded the lead PEL, the worker exposure was 440 ug/m³. No specific reason could be determined by the Asarco representative for the one worker's elevated lead result. The floors of the boxcars and the bundles of lead ingots were observed to be clean.

An industrial hygiene survey of lead exposure during the unloading of lead ingots from railroad cars was conducted on August 7, 1991 by Hazcon, Inc. During this survey it was noted that lead ingot were transferred from gondolas to shipping containers instead of transferred from boxcars to the shipping containers. Black dust up to approximately 0.5-inch-thick was noted in the corners of the gondolas. In addition, lead alloy scape was observed inside the gondolas. Laboratory results on samples obtained from the black dust revealed concentrations up to 5,600 parts per million (ppm). Large clouds of dust were noticed when a forklift drove on the unpaved roadway south of the loading dock. Personal samples were collected on all four workers for the duration of the unloading and loading process. All personal samples were below the PEL and action levels for both lead and arsenic. Several recommendations were made to reduce employee lead exposures, and additional wipe and bulk samples to assess the environmental impact from ingot transfer and transport operations were suggested.

In general, industrial hygiene survey results indicated the boxcars, the dock area, the forklifts and the shipment containers were contaminated with lead dust. The source of airborne lead exposure has been speculated in most surveys to be the fugitive dust from the lead ingots.

During the Furnace-Kettle Refining process or the Pyrometallurgical process for lead, several impurities have been encountered such as antimony, arsenic, tin and chromium. The most common ore mined and utilized in the lead production is Galena, a blend of lead, white iron pyrites and zinc. Other common ores are Crocoite ore, an oxygenated lead and chromium mixture, and lead arsenate and oxygenated lead and arsenic mixture.

4.0 SITE CONDITIONS

4.1 Regional Geology

The Port Terminal 106 West is located in the Duwamish Valley, which is part of the Puget Lowland, a topographical and structural trough between the Cascade Mountain Range and the Olympic Mountains. This area has been influenced and altered by at least three Quaternary-age glaciations which have, in turn, been separated by long inter-glacial intervals. During the last major glaciation identified as the Vashon, a lobe of the Continental Ice Sheet, estimated to be several thousand feet thick, moved southward across this area, deepening and widening the existing north-trending valleys such as the ancestral Duwamish.

As the ice mass retreated, the major drainage basins experienced extensive fluvial aggradation, accumulating thick deposits of sand and silt. The mouths of major drainage channels, such as the Duwamish, became estuarine deltas (i.e., transitional zones where marine and river deposits intermingle). The process of alternating removal and deposition of alluvium and fluvial-marine sediments in this environment resulted in the formation of a complex geometry of material types. The alluvial sands and silts and fluvial-marine silts and clays deposited in the Duwamish Valley are up to 250 feet thick. These deposits are underlain by glacially-overridden deposits of till (an unsorted mixture of sand, silt, gravel, and clay) and glacio-lacustrine silt and clay.

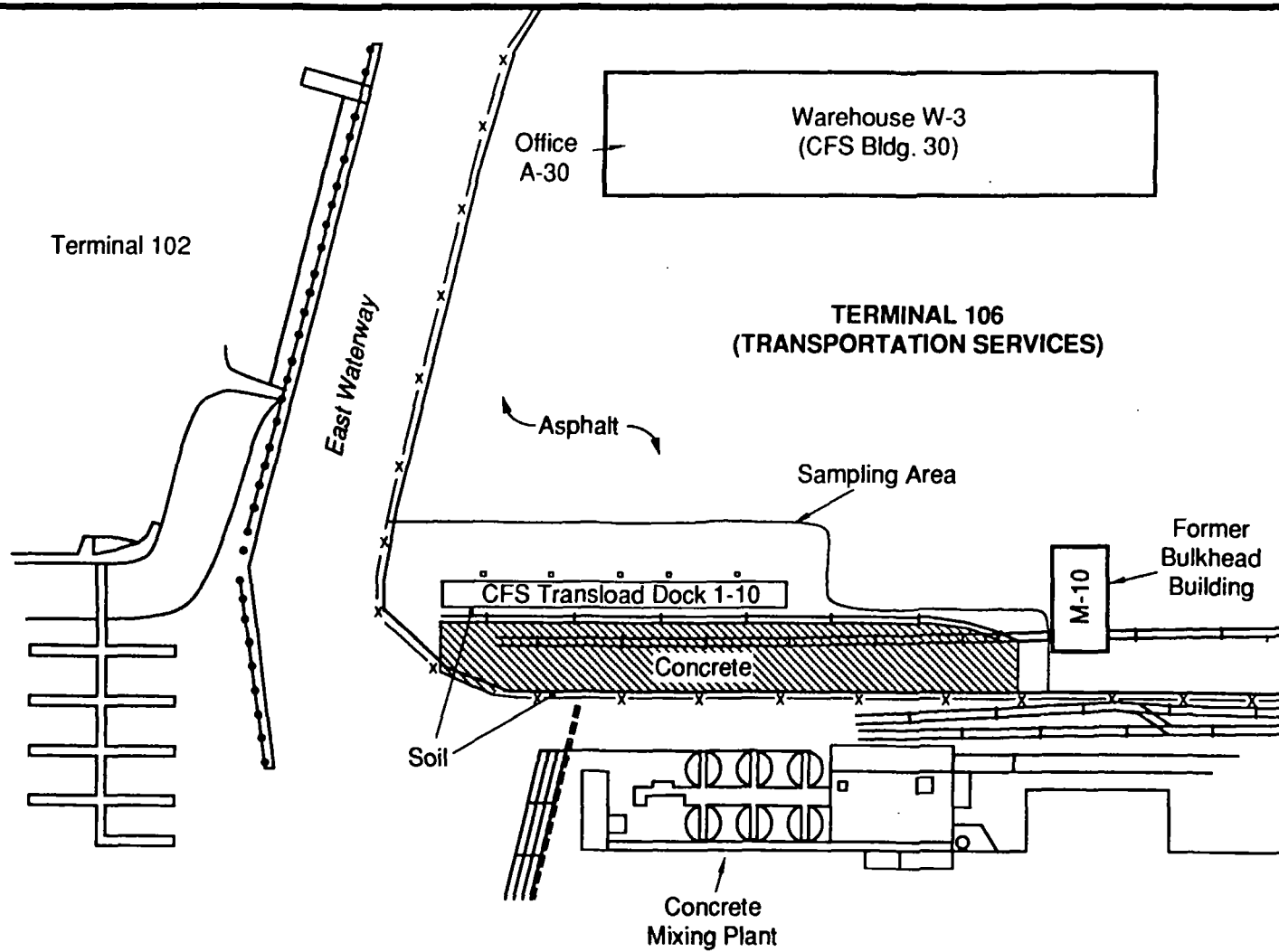
4.2 Subsurface Soil Conditions

The following description of subsurface soil conditions is based upon a search of Shannon & Wilson files, which included old shoreline maps and a variety of projects in the vicinity of the site. The subsurface conditions at the site are inferred from conditions known to exist at nearby properties.

Prior to the late 1800's, the site consisted of shallow meandering channels, marsh land, and tidal mud flats. Beginning in 1895 and continuing into the 1920's, the area was built up above sea level by placing hydraulic fill to an elevation of between 2 and 10 feet above the mean high tide level, which is 2.10 feet below the City of Seattle Datum (City of Seattle, Standard Plan No. 217, "Supplement to Standard Specifications for Municipal Public Works Construction," 1976).

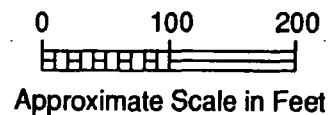
The subsurface soils present at the site consist of fill, alluvial and fluvial-marine deposits, and glacial deposits. Fill is likely to be present to a depth of between 2 and 17 feet, consisting of loose to dense sand, silt, gravel, and ash. Underlying the fill are alluvial and fluvial-marine deposits which typically consist of loose to medium dense sand, locally very dense, with numerous layers of soft to stiff silt and clayey silt. These materials extend to approximately 170 feet on the eastern portion of the site and become deeper to the west (approximately 200 feet). These deposits are underlain by very dense glacial till.

Groundwater has been measured in the vicinity of the site between elevations 1.0 and -3.8 feet (City of Seattle Datum). It is estimated at this site, groundwater elevation is 10 feet beneath the ground surface, approximately. The groundwater level is expected to fluctuate on the order of 3 to 4 feet due to tidal variations. Groundwater was not encountered in any of the shallow boreholes installed during this investigation.



LEGEND

- x-x- Fence
- ⊥⊥⊥ Railroad
- Catch Basin



Port of Seattle
 Supplement 2 - Terminal 106 West (C.F.S.)
 Seattle, Washington

SITE PLAN

January 1992

T-1321-01

SHANNON & WILSON, INC.
 Geotechnical and Environmental Consultants

FIG. 1

FIG. 1

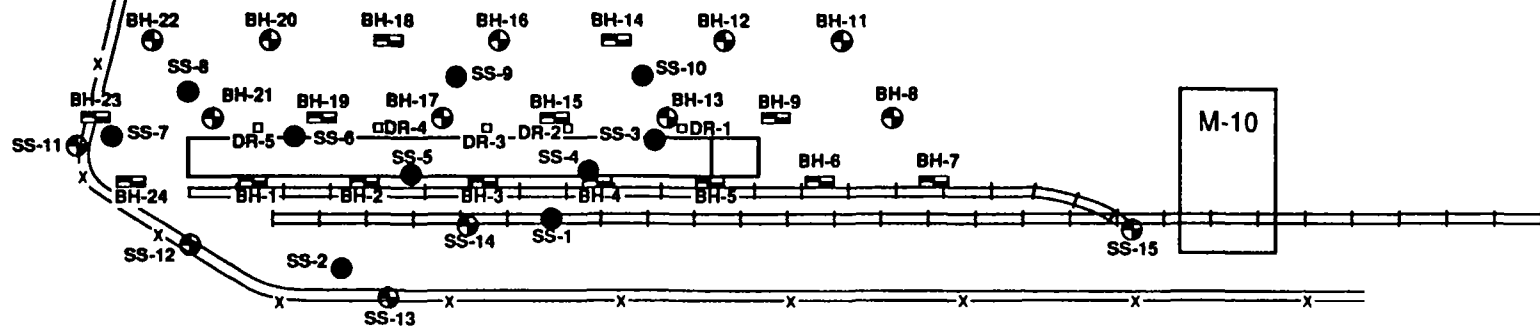
Warehouse W-3 (CFS Building 30)

TERMINAL 106
(TRANSPORTATION SERVICES)

BH-10

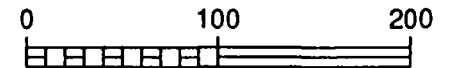
East Waterway

N



M-10

Concrete Mixing Plant



Approximate Scale in Feet

LEGEND

-x-x- Fence

⊥⊥ Railroad

DR-1 □ Catch Basin

BH-8 ⊕ Surface Sampling Location

BH-1 ⊞ Surface and Subsurface Location

SS-6 ● Wipe Sample Location

Port of Seattle
Supplement 2 - Terminal 106 West (C.F.S.)
Seattle, Washington

SAMPLING LOCATION

January 1992

T-1321-01

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FIG. 2

FIG. 2